Test Material: Dicamba

MRID: 49067704

Title: Off Field Deposition of BAS 183 H Containing Formulations Using Various Nozzles

EPA PC Code: 128931

OCSPP Guideline: 835.6100

For CDM/CSS-Dynamac JV

Primary Reviewer: Joan Gaidos **Signature:**

Date: 9/30/16

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Date: 9/30/16

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Date: 9/30/16

This Data Evaluation Record may have been altered by the Environmental Fate and Effects Division subsequent to signing by CDM/CSS-Dynamac JV personnel.

Terrestrial Field Deposition of Dicamba following Spray Application

Report:	MRID 49067704. Jackson, S.H. 2013. Off Field Deposition of BAS 183 .. H Containing Formulations Using Various Nozzles. Unpublished study performed by BASF Crop Protection, Research Triangle Park, North Carolina; Pyxant Labs Inc., Colorado Springs, Colorado; University of Nebraska, North Platte, Nebraska. Study sponsored by BASF Crop Protection, Research Triangle Park, North Carolina. BASF Study No.: 429625. Study initiated on June 11, 2012, and completed March 1, 2013 (pp. 1, 6).
Document No.:	MRID 49067704
Guideline:	OCSPP 835.6100
Statements:	Signed and dated Data Confidentiality, GLP Compliance, Quality Assurance, and Authenticity Certification statements were provided (pp. 2-5). This study was not conducted according to the USEPA FIFRA Good Laboratory Practice (GLP) Standards (40 CFR Part 160).
Classification:	This study is supplemental. The registrant did not directly verify application rates in the field. The distinction between low and high wind speed application conditions appeared to have considerable overlap and may not have provided a clear distinction of formulation behavior with various nozzles under these defined conditions. An independent laboratory method validation was not conducted. A control plot was not established. The stability of the dicamba formulations was not determined.
PC Code:	128931
Reviewer:	William P. Eckel, Ph.D. Senior Science Advisor, ERB6

Signature: William P. Eckel
Date: 10/11/2016

Executive Summary

Deposition of three dicamba (BAS 183 H) containing formulations was determined in combination with three different nozzle types following EPA's Drift Reduction Protocol. The three formulations of dicamba tested were BAS 183 09H (Clarity®), BAS 183 22H (Engenia™) and BAS 183 22H with Roundup PowerMAX 540SL. All tank mixes also contained 0.25% Induce as a non-ionic wetter adjuvant. The formulations were applied at a nominal rate of 1 lb/ac through each of three nozzles types: XR 8004, TTI 11004 and AIXR 11004. Each of the nine formulation/nozzle combinations were tested at low and high wind conditions for a total of 18 treatments. Dicamba was measured based on direct deposition on horizontal fallout collectors located downwind from the treatment area at three sampling transects with petri dishes at distances of 4, 8, 16, 32, 45, 60, 75, 90, 105 and 120 meters. Dishes were collected 15 minutes after the last of 3 application passes and analyzed for dicamba. The test site was located near North Platte, Nebraska in a field with corn stubble present. The allowable wind vectors to enable the spray to be intercepted by the first line of collectors at 120 meters was Southeast to Southwest.

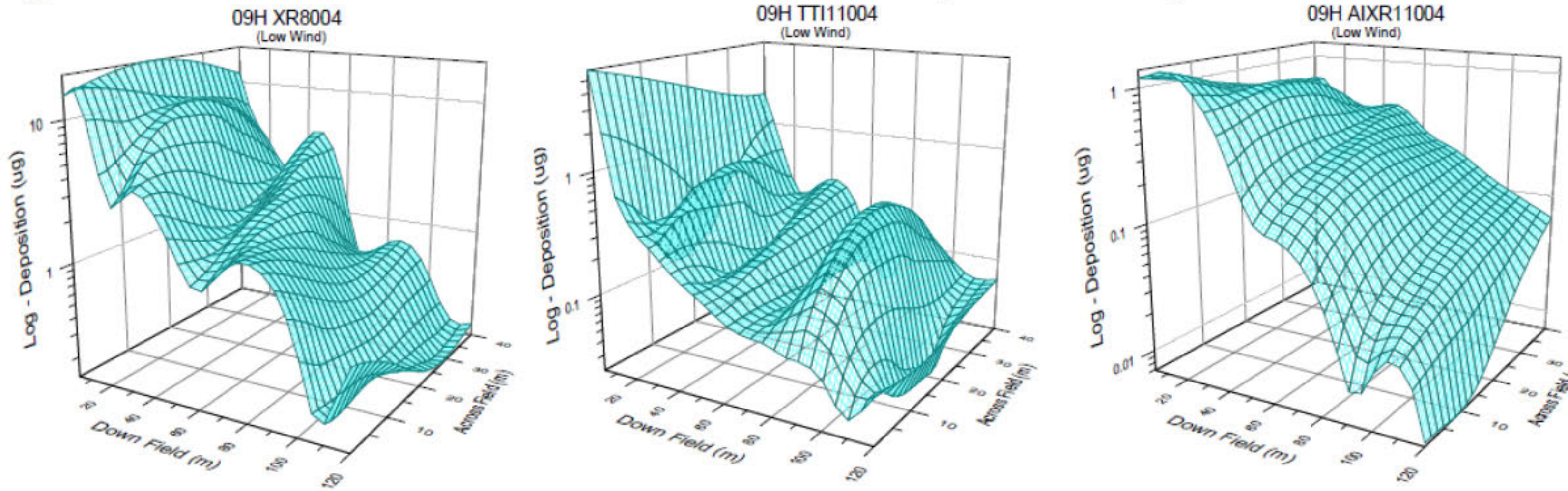
The study author determined the fraction of applied by dividing the full label application rate per petri dish area by the average µg captured at any given distance. At low wind treatments, nozzle TTI 11004 has the lowest fraction of applied at 120 meters, ranging from 7.980E-05 to 2.782E-05 fraction of dicamba applied. At low wind speed, the XR nozzle ranged from 4.162E-04 to 1.368E-04 fraction of dicamba applied and the AIXR nozzle ranged from 1.258E-05 to 2.771E-04 fraction of dicamba applied. Under high wind conditions the TTI 11004 ranged from 9.9849E-05 to 2.1642E-04 fraction of dicamba applied; the XR nozzle ranged from 1.6322E-04 to 1.3229E-03 fraction of dicamba applied; and the AIXR nozzle ranged from 8.6751E-04 to 2.0937E-04 fraction of dicamba applied.

The study author also calculated the buffer distance needed to reach a specific non-target plant NOEC for dicamba using the risk based buffer approach. These results provide a variance of buffer distances based on reaching the non-target NOEC of 0.00026 lbs/A. Buffer distances were estimated for application rates of 1 lb/A and 0.5 lb/A. For all treatments, the TTI 11004 nozzle consistently required the lowest buffer distance, which ranged from 7 to 30 feet under low wind conditions and 62 to 133 feet under high wind conditions at the 0.5 lb/A treatment level. The XR nozzle buffer distances ranged from 134 to 250 feet under low wind conditions and 132 to >380 feet under high wind conditions at the 0.5 lb/A treatment level. The AIXR nozzle buffer distances ranged from 27 to 264 feet under low wind conditions and 174 to >380 feet under high wind conditions at the 0.5 lb/A treatment level.

Under a maximum allowable wind speed of 10 mph, the TTI 11004 nozzle was the best option for minimizing off field movement of the three formulations containing dicamba. Based on the dicamba non-target NOEC of 0.00026 lbs/ac, a buffer distance of about 106 feet would be required using a TTI 11004 nozzle. This distance is based on the in season application rate of 0.5 lbs/ac.

Note: All results in Figures 1-3 reported by the registrant in the registrant-prepared study for MRID 49067704.

Figure 1a. 3D Surface Plots for BAS 183 09H Formulation, Low Wind, Nozzles XR8004, TTI11004 and AIXR11004.

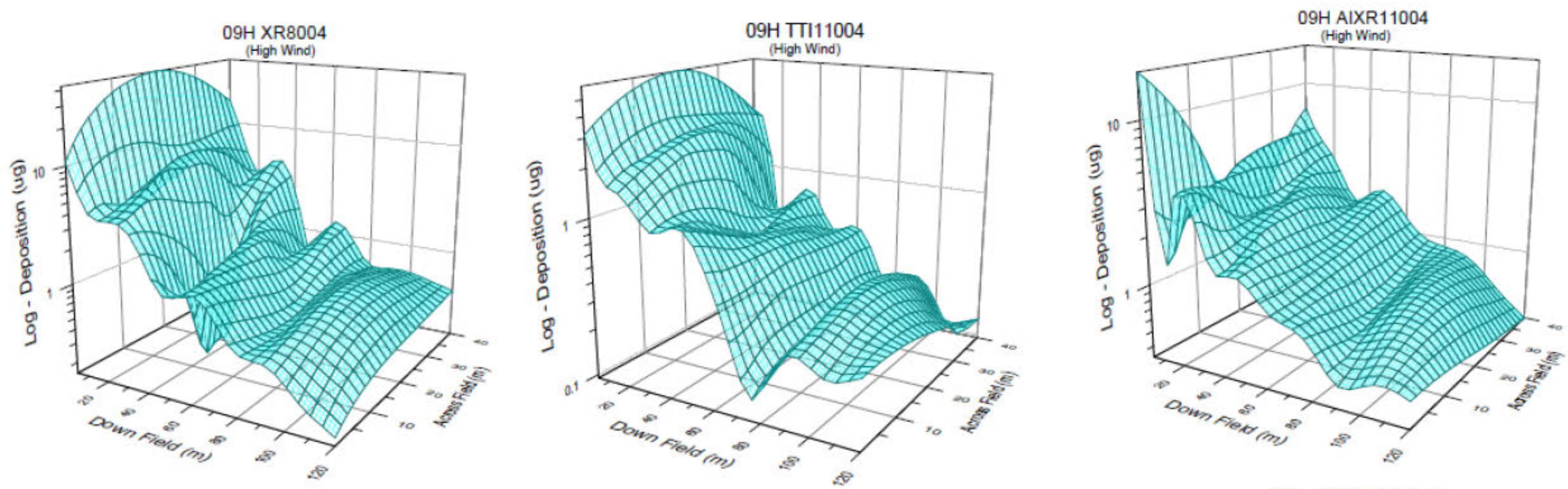


Wind 4.0-7.5, SSE

Wind 2.0-10, SW

Wind 4.0-7.0, SW

Figure 1b. 3D Surface Plots for BAS 183 09H Formulation, High Wind, Nozzles XR8004, TTI11004 and AIXR11004.

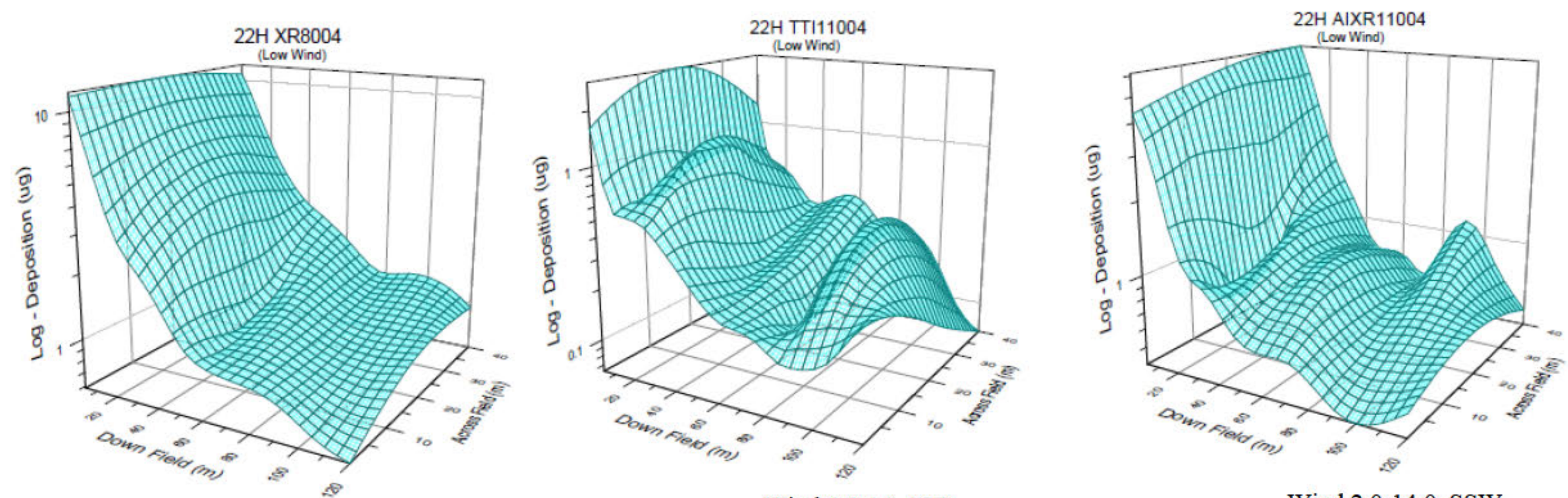


Wind 6.0-18.0, S

Wind 6.0-14, SSE

Wind 9.0-15.0, S

Figure 2a. 3D Surface Plots for BAS 183 22H Formulation, Low Wind, Nozzles XR8004, TTI11004 and AIXR11004.



Wind 4.0-9.0, S

Wind 4.0-14, SSE

Wind 2.0-14.0, SSW

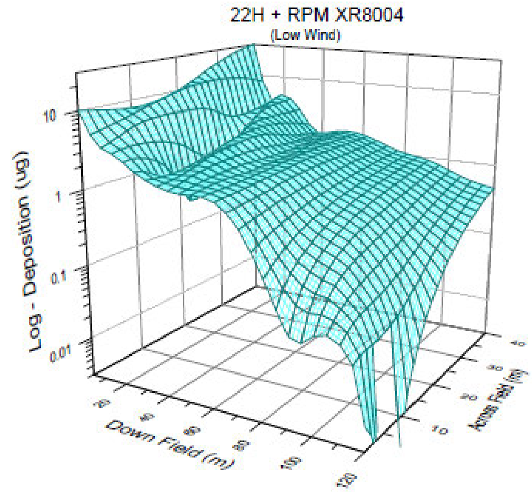
Figure 2b. 3D Surface Plots for BAS 183 22H Formulation, High Wind, Nozzles XR8004, TTI11004 and AIXR11004.

Wind 3.0-9.0, SSW

Wind 3.0-18, SSE

Wind 6.0-16.0, SSE

Figure 3a. 3D Surface Plots for BAS 183 22H + RPM Formulation, Low Wind, Nozzles XR8004, TTI11004 and AIXR11004.



Wind 6.0-13.0, S

Wind 6.0-12, S

Wind 2.0-8.0, SSE

Figure 3b. 3D Surface Plots for BAS 183 22H + RPM Formulation, High Wind, Nozzles XR8004, TTI11004 and AIXR11004.

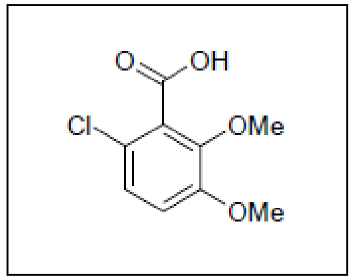
Wind 6.0-16.0, SSE

Wind 8.0-16, S

Wind 6.0-18.0, SSW

I. Materials and Methods

A. Materials



1. Test Material

Product Name: BAS 183 H (p. 6)
Formulation Type: Not reported
CAS #: 104040-79-1 (dicamba diglycolamine salt)
Chemical Name: 'salts' of 3,6-dichloro-o-anisic acid.

Formulations tested included:

A. BAS 183 09 H: A 4lb/gal commercial formulation of Clarity® Herbicide (lot No.: 2086B01B5).
B. BAS 183 22 H: A 5lb/gal development formulation of Engenia™ (lot No.:2023B01DD).
C. BAS 183 22 H + RPM: Roundup Powermax™, a 4lb/gal commercial formulation (lot No.: M12T0427AJ).

All tank mixes contained 0.25% Induce®, a nonionic wetter adjuvant (p. 11).

Storage stability: Stability of the active ingredient dicamba in the test substance BAS 183 H was not determined.

2. Storage Conditions

The test substances were shipped under ambient conditions by BASF Crop Protection and received by University of Nebraska West Central Research and Extension Center in North Platte Nebraska (p. 11). All products were held under ambient temperatures prior to use. Tank mix samples ranged from 71 to 87°F prior to the application (p. 263). All field samples were placed in coolers before being frozen for transport to the laboratory, freezer storage temperatures were continuously monitored and recorded, and ranged from -28 to -13.6°C; samples were stored frozen at the lab at <-20°C (pp. 15, 43, 97; Appendix 4, p. 262).

B. Study Design

1. Site Description

The test site was located 8 miles south of North Platte, Nebraska, near Lake Maloney (p. 11). The treated area was 110 meters wide and 305 meters long (approximately 8 acres; p. 12). The off target deposition collection area was 40 meters wide and 120 meters long and located downwind of the prevailing winds (Figure 3, p. 13). Deposition was directly measured using horizontal fallout collectors located in three parallel lines of collectors spaced approximately 15 meters apart with the center line located at the center of the application area. The deposition collectors consisted of 150 mm petri dishes set up as three sampling transects (replicates) each of which had a set of petri dishes set at 4, 8, 16, 32, 45, 60, 75, 90, 105 and 120 meters from the treatment area (pp. 14, 16).

The field was rotated out of no-till corn and contained stubble approximately 12-18 inches tall (p. 14). Field cropping history was not reported.

2. Application Details

Application rate(s):	The target application rate was 1.0 lb/A (p. 14). The application rate was not monitored in the treated area.
Irrigation and Water Seal(s):	No irrigation water was used. Tank mix water was held onsite in a nurse tank (p. 14).
Tarp Applications:	Tarps were not used.
Application Equipment:	A commercial John Deere 4940 tractor was equipped with a 120 foot boom with 47 test nozzles spaced 30 inches apart (p. 13). Formulations were applied in 3 passes controlled by onboard computerized GPS speed control after initial calibration. Nozzles were on a turret that were rotated manually with each nozzle change. Boom height was set at 24 inches above ground, and automated hydraulic boom stabilization system was used to control height while spraying (p. 14). Additional description of spray equipment was not provided.
Equipment Calibration Procedures:	The sprayer output was calibrated using the time pass capture method, but onboard computer system controlled the machine better and was used instead (pp. 13-14). Three hundred gallons were mixed for each treatment. The carrier volume was 95 L/ha (10 GPA; Table 2, p. 14). For the dicamba plus glyphosate treatments, full rates of each were mixed for spraying.
Application Regime:	The application rates and methods for each formulation used in the study are summarized in **Table 1**. The adjuvant Induce® (0.25% v/v) was added to the spray mixture (pp. 14, 19). Rhodamine dye was also added to the tank mix (0.2%) to confirm spray particle behaviour in virtual real time, but not used to describe deposition. The sprayer made three passes on the treated field and the petri collection dishes covered and picked up approximately 15 minutes after the last pass (p. 14).

Table 1. Summary of application methods and rates for BAS 183 H (Dicamba)

Table 1. Study treatment summary.

Treatment	Formulation	Rate (lb/ac)	Nozzle	Carrier Volume (gpa)	Travel Speed (mph)
1	BAS 183 09H [1]	1	XR 8004	10	10
2	BAS 183 09H [1]	1	TTI 11004	10	10
3	BAS 183 09H [1]	1	AIXR 11004	10	10
4	BAS 183 22 H [1]	1	XR 8004	10	10
5	BAS 183 22 H [1]	1	TTI 11004	10	10
6	BAS 183 22 H [1]	1	AIXR 11004	10	10
7	BAS 183 22 H [1 & 2]	1	XR 8004	10	10
8	BAS 183 22 H [1 & 2]	1	TTI 11004	10	10
9	BAS 183 22 H [1 & 2]	1	AIXR 11004	10	10

[1] Induce (NIS) @ 0.25% v/v
[2] Roundup PowerMax 540SL @ 1 lb ae/ac

Table reported by the registrant in the registrant-prepared study profile for MRID 49067704 (p. 11).

Application Scheduling: The 9 treatments combinations were made in low wind speed and high wind speed conditions for a total of 18 treatments. Mean wind speed during low wind speed conditions ranged from 4.07 to 8.15 mph and high wind speed conditions ranged from 4.34 to 10.44 mph (p. 19). The allowable wind vectors to enable the spray to be intercepted by the first line of collectors at 120 meters was Southeast to Southwest based on treated area/deposition area specific geometries (p. 18).

3. Soil Properties

Not reported.

4. Meteorological Sampling

An onsite HOBO meteorological station was located south of the study area with good fetch within 30 meters of the treated area (p. 13). The station took measurements every 5 seconds, which were averaged every 30 seconds, and recorded. The station measured air temperature (2m height), relative humidity (2 m height), and wind speed and direction (3 m height). **Table 2** summarizes the meteorological conditions during spraying for each treatment combination. The acceptable wind vectors during spraying were southwest to southeast.

Table 2. Summary of treatment and relevant weather conditions during spraying.

Treatment	Mix	Nozzle	Start	Stop	Wind	Date	Mean Wind (mph)	Mean Dir. (deg.)	Gust To (mph)	Dir
T1	BAS 183 09H	XR	9:34	9:41	L	7/17/2012	4.85	153.99	6.28	SSE
T2	BAS 183 09H	TTI	10:00	10:05	L	7/17/2012	4.67	225.91	5.81	SW
T3	BAS 183 09H	AIXR	10:20	10:26	L	7/17/2012	4.07	234.96	5.13	SW
T4	BAS 183 22H	XR	11:16	11:22	L	7/17/2012	4.86	194.24	5.96	SSW
T5	BAS 183 22H	TTI	11:36	11:41	L	7/17/2012	7.05	168.61	8.79	SSE
T6	BAS 183 22H	AIXR	11:54	11:59	L	7/17/2012	5.36	197.49	6.88	SSW
T7	22H+RPM	XR	10:39	10:44	L	7/19/2012	8.15	170.41	10.08	S
T8	22H+RPM	TTI	10:22	10:26	L	7/19/2012	7.24	186.56	8.67	S
T9	22H+RPM	AIXR	10:05	10:09	L	7/19/2012	4.29	159.40	5.30	SSE
T10	BAS 183 09H	XR	14:44	14:50	H	7/17/2012	8.57	176.19	10.85	S
T11	BAS 183 09H	TTI	15:03	15:08	H	7/17/2012	8.47	171.18	10.13	S
T12	BAS 183 09H	AIXR	15:28	15:32	H	7/17/2012	9.71	172.68	11.79	S
T13	BAS 183 22H	XR	16:26	16:31	H	7/17/2012	4.34	209.45	5.85	SSW
T14	BAS 183 22H	TTI	16:45	16:49	H	7/17/2012	7.35	165.95	9.59	SSE
T15	BAS 183 22H	AIXR	17:03	17:08	H	7/17/2012	8.03	165.89	9.82	SSE
T16	22H+RPM	XR	12:53	12:59	H	7/17/2012	9.01	167.46	11.30	SSE
T17	22H+RPM	TTI	13:17	13:21	H	7/17/2012	10.25	185.31	12.87	S
T18	22H+RPM	AIXR	13:35	13:40	H	7/17/2012	10.44	192.10	12.94	SSW
rpm = Roundup Powermax										

Table reported by the registrant in the registrant-prepared study profile for MRID 49067704 (p. 19).

5. Deposition Capture

The off-field drift was captured in three sampling transects with standard 150 mm (6 inch) petri dishes set at sampling intervals of 4, 8, 16, 32, 45, 60, 75, 90, 105 and 120 meters from the treatment area (p. 14,16). Approximately 15 minutes after the last of three sampling passes, the dishes were covered and placed in coolers for transport to the lab where they were frozen.

Using the depositions analysis detailed below, the study author determined that by using a low wind speed estimation of 5 mph, airborne particles would travel 26,400 ft in 1 hour (p. 18). This is equivalent to particles moving 6,600 ft in 15 minutes. Since the maximum capture distance was approximately 400 ft (120 m), the collection time was well within the estimated travel speed. Also, the 15 minutes between the last application and capture is a historical method (not referenced).

6. Sample Handling and Storage Stability

The test substances were shipped under ambient conditions by BASF Crop Protection and received by University of Nebraska West Central Research and Extension Center in North Platte Nebraska (p. 11). All products were held under ambient temperatures prior to use. Tank mix samples ranged from 71 to 87°F prior to the application (p. 263). All field samples were placed in coolers before being frozen for transport to the laboratory, freezer storage temperatures were continuously monitored and recorded, and ranged from -28 to -13.6°C; samples were stored frozen at the lab at <-20°C (pp. 15, 43, 97; Appendix 4, p. 262).

The stability of the dicamba formulations was not determined.

7. Analysis of Deposition Data

To calculate the buffer distance to reach a specified non-target plant NOEC, the average deposition value at each distance was determined (p. 16). This allows the creation of x,y pairs for regression, distance and deposition. Since in this study the goal for each set of conditions (wind, nozzle and formulation) was to calculate a distance for any given level of concern (our NOEC), regressants were swapped y for x and x for y so that we can predict distance for any given concentration (p. 15). Once the data were log/log transformed, they were analyzed using simple regression with the value for x representing the non-target most sensitive species endpoint NOEC for dicamba of 0.00026 lb/A (equivalent to 0.6 µg/deposition dish). An example using the BAS 183 09H formulation with the XR8004 nozzle under high wind conditions is reported in **Table 3**.

Table 3. Example data analysis dataset for the Clarity formulation using an XR8004 nozzle with high wind conditions.

Dist.	ug	log ug	log DIst.	x	y
4	21.32	1.329	0.602	1.329	0.602
8	7.986	0.902	0.903	0.902	0.903
16	3.598	0.556	1.204	0.556	1.204
32	2.298	0.361	1.505	0.361	1.505
45	0.9	-0.046	1.653	-0.046	1.653
60	0.966	-0.015	1.778	-0.015	1.778
75	0.6166	-0.210	1.875	-0.210	1.875
90	0.6098	-0.215	1.954	-0.215	1.954
105	0.5016	-0.300	2.021	-0.300	2.021
120	0.324	-0.489	2.079	-0.489	2.079

Table reported by the registrant in the registrant-prepared study profile for MRID 49067704 (p. 16).

Once data were log/log transformed, they could be analyzed using a simple regression method (y = mx + b). The value for x was the dicamba non-target most sensitive species endpoint NOEC of 0.00026 lb/ac equivalent or 0.6 µg/deposition collector (the petri dish).

Example Calculation:

calculated (y)	m	b	log of ug (x)
1.90573779	-0.850	1.71698	-0.221

Where
m=the slope of the line,
b=the line intercept
x=log of 0.6 µg deposition
By substitution of x in the simple regression,

y=1.9057 log meters
10y = 80.5 meters or 264 feet

Therefore, to achieve deposition of 0.6 µg, a distance of 264 ft. would be required under high wind conditions for this nozzle type and formulation.

Additional details of the analytical analysis are in the appended report, “Off field Deposition of BAS 183 .. H Containing Formulations Using Various Nozzles, Analytical Summary Report” BASF Study No.: 429625 Pyxant Study No.: 2473.

The fraction of applied was determined by dividing the full label application rate per petri dish area by the average µg captured at any given distance. An example is provided in **Table 4**.

Table 4. Example calculation table for fraction of applied.

Formulation	Nozzle	
Clarity	XR8004	ug / 1985 ug
Dist.	ug	Frac of Applied
4	21.32	0.01074
8	7.986	0.00402
16	3.598	0.00181
32	2.298	0.00116
45	0.9	0.00045
60	0.966	0.00049
75	0.6166	0.00031
90	0.6098	0.00031
105	0.5016	0.00025
120	0.324	0.00016

Wind - high

Table reported by the registrant in the registrant-prepared study profile for MRID 49067704 (p. 26).

8. Analytical Methodology

The analytical method used was derived from “Procedure to Determine BAS 183 22H (Dicamba) Residue from Air Filtering Devices” and from AP Sciex API 4000 method (pp. 43-44).
The analytical method was validated for each batch analysis by fortifying control petri dishes or speedisks and analyzing with each batch along with a reagent blank and reagent blank spike. Procedural recoveries were determined by fortifying petri dishes or speedisks with dicamba over a range of 0.009 to 2400 µg/sampling device and analyzing for dicamba.

The validated LOQ was 0.009 µg dicamba/sampling device. The method LOD was 0.003 µg dicamba/sampling device (p. 97).

Residues of dicamba in all samples were analyzed using LC/MS/MS detection with a Luna Phenyl-Hexyl column (150 x 3.0 mm, 3µm), in negative ionization mode to monitor dicamba ion transitions from *m/z* 218.9 to 174.8 (pp. 45, 100).

9. Quality Control

The 0.009 µg fortification for field extracted samples were analyzed without further dilution; all other field extracted samples were diluted between 1 and 20,000 with methanol /water (10/90, v/v; p.44). Petri dish recoveries for 0.009, 0.20, 360 and 2400 µg/petri dish fortifications from field extracted samples were 106 ± 9.6% (n = 19), 97.8 ± 4.3% (n = 12), 90.1 ± 5.9% (n = 9) and 89.0 ± 6.9% (n = 3), respectively (Table 1, pp. 47-48).

Field fortified samples were diluted between 10 and 2,500 with methanol/water (10/90, v/v). Petri dish recoveries for replicate 0.20 and 360 µg/petri dish fortifications from field fortified samples were 102 ± 20% (n = 9, Replicate A)/94.8 ± 2.3% (n = 9, Replicate B), and 83.1 ± 0.7% (n = 9, Replicate A)/83.6 ± 1.5% (n = 9), respectively (Table 3, pp. 50-51).

All speedisk samples were diluted between 1 and 20,000 with methanol/water (10/90, v/v). Speedisk procedural recoveries for 0.0090, 0.20, and 2400 µg/disk fortifications samples were 107 ± 12% (n = 5), 101 ± 10% (n = 5), and 86.5 ± 8.0% (n = 4), respectively (Table 2, p. 49).

10. Wind speed Tunnel Evaluation of Engenia

Several nozzles and spray solutions were analyzed with a Sympatec Helos Vario KR particle size analyzer capable of detecting particle sizes in a range from 0.5 to 1850 microns using laser diffraction to determine particle size distribution (p. 257). The width of the nozzle plume was analyzed by moving the nozzle across the laser by means of a linear actuator. All testing was performed in a low speed wind tunnel at 15 mph. Nine spray solutions were evaluated through three nozzles, and each treatment was replicated at least three times. The nozzles tested were the TeeJet AIXR11004, TTI11004, and the XR8004 at 63 PSI. Dv10 is the micron size (µm) at which 10 percent of the spray volume is of the reported size and smaller. Dv50 and Dv90 are similar statistics. The percent less than 105 µm (Pct <105 µm) is the percentage of the spray volume that is 105 µm and smaller, with percent less than 150 µm (Pct <150 µm), 210 µm (Pct <210 µm), and 730 µm (Pct<730 µm) being similar measurements. The data were analyzed using a mixed model ANOVA (PROC MIXED) with Replication set as random in SAS 9.2. The mean separations were conducted at the $\alpha = 0.05$ level using a Tukey adjustment.

II. Results and Discussion

A. Fraction of Applied

The fraction of applied was based on the registrant calculations of dividing the full label application rate per petri dish area by the average µg captured at 120 meters is reported in **Table 5** (p. 26).

For all low wind treatments (T1-T9) and high wind treatment with BAS 183 09H formulation, nozzle TTI 11004 has the lowest fraction of applied at 120 meters, ranging from 7.980E-05 to 2.782E-05 fraction of dicamba applied. At low wind speed, the XR nozzle ranged from 4.162E-04 to 1.368E-04 fraction of dicamba applied and the AIXR nozzle ranged from 1.258E-05 to 2.771E-04 fraction of dicamba applied. Under high wind conditions the TTI 11004 ranged from 9.9849E-05 to 2.1642E-04 fraction of dicamba applied; the XR nozzle ranged from 1.6322E-04 to 1.3229E-03 fraction of dicamba applied; and the AIXR nozzle ranged from 8.6751E-04 to 2.0937E-04 fraction of dicamba applied.

Table 5. Summary of fraction of applied results at 120-meter distance.

Treatment	Tank Mix	Nozzle	Fraction of Applied
T1	09H	XR	1.492E-04
T2	09H	TTI	2.782E-05
T3	09H	AIXR	1.258E-05
T4	22H	XR	4.162E-04
T5	22H	TTI	7.980E-05
T6	22H	AIXR	2.771E-04
T7	22H+RPM	XR	1.368E-04
T8	22H+RPM	TTI	7.980E-05
T9	22H+RPM	AIXR	4.450E-04
T10	09H	XR	1.6322E-04
T11	09H	TTI	9.9849E-05
T12	09H	AIXR	2.0937E-04
T13	22H	XR	1.7521E-03
T14	22H	TTI	2.1642E-04
T15	22H	AIXR	2.8443E-04
T16	22H+RPM	XR	1.3229E-03
T17	22H+RPM	TTI	2.2398E-04
T18	22H+RPM	AIXR	8.6751E-04

Table reported by the registrant in the registrant-prepared study profile for MRID 49067704 (p. 26).

The study author also calculated the buffer distance needed to reach a specific non-target plant NOEC for dicamba using the risk based buffer approach (Jackson et al 2012; **Table 6**). Buffer distances were estimated for application rates of 1 lb/A and 0.5 lb/A (p. 27). The Volume Median Diameter (VMD_{50}) measurements were generated at the University of Nebraska low speed wind tunnel.

For all treatments, the TTI 11004 nozzle consistently required the lowest buffer distance, which ranged from 7 to 30 feet under low wind conditions and 62 to 133 feet under high wind conditions at the 0.5 lb/A treatment level. The XR nozzle buffer distances ranged from 134 to 250 feet under low wind conditions and 132 to >380 feet under high wind conditions at the 0.5 lb/A treatment level. The AIXR nozzle buffer distances ranged from 27 to 264 feet under low wind conditions and 174 to >380 feet under high wind conditions at the 0.5 lb/A treatment level.

Table 6. Summary of buffer distances calculated for each treatment.

Treatment	Mix	Nozzle	VMD_{50}	Wind	Mean Wind (mph)	Resulting Buffer 1 lb/ac (feet)	Resulting Buffer 0.5 lb/ac (feet)
T1	09H	XR	236	L	4.85	293	147
T2	09H	TTI	713	L	4.67	58	29
T3	09H	AIXR	432	L	4.07	53	27
T4	22H	XR	256	L	4.86	>380	250
T5	22H	TTI	590	L	7.05	60	30
T6	22H	AIXR	419	L	5.36	240	120
T7	22H+RPM	XR	202	L	8.15	268.00	134
T8	22H+RPM	TTI	673	L	7.24	13.00	7
T9	22H+RPM	AIXR	360	L	4.29	527.00	264
T10	09H	XR	236	H	8.57	264	132
T11	09H	TTI	713	H	8.47	123	62
T12	09H	AIXR	432	H	9.71	347	174
T13	22H	XR	256	H	4.34	>380	250
T14	22H	TTI	590	H	7.35	212	106
T15	22H	AIXR	419	H	8.03	367	184
T16	22H+RPM	XR	202	H	9.01	>380	>380
T17	22H+RPM	TTI	673	H	10.25	266.00	133
T18	22H+RPM	AIXR	360	H	10.44	>380	>380

RPM = Roundup Powermax™

Table reported by the registrant in the registrant-prepared study profile for MRID 49067704 (p. 27).

These results provide a variance of buffer distances based on reaching the non-target NOEC of 0.00026 lbs/A. Under a maximum allowable wind speed of 10 mph, the TTI 11004 nozzle was the best option for minimizing off field movement of three formulations containing dicamba (p. 28).

Based on the dicamba non-target NOEC of 0.00026 lbs/ac and the in season application rate of 0.5 lbs/A, a buffer distance of about 106 feet would be required using a TTI 11004 nozzle (p. 10).

III. Study Deficiencies and Reviewer's Comments

1. The registrant did not directly verify application rates in the field. However, the fraction of applied was calculated based on the full label application rate (p. 26).

2. The distinction between low and high wind speed application conditions appeared to have considerable overlap and may not have provided a clear distinction of formulation behavior with various nozzles under these defined conditions. The low wind speed conditions ranged

from 4.07 to 8.15 mph and high wind speed conditions ranged from 4.34 to 10.44 mph (Table 7, p. 27).

3. Analytical method validation was performed, but the method was not independently validated. A method validation study should be completed from an independent laboratory separate from and prior to the analysis of the test samples to verify the analytical methods.

4. A control plot was not established.

5. The stability of the dicamba formulations was not determined.

IV. References

U.S. EPA Generic Verification Protocol for Testing Pesticide Application Spray Drift Reduction Technologies for Row and Field Crops. (2012, 2011 DRAFTS). EPA Office of Pesticide Program, One Potomac Yard, 2777 S. Crystal Drive, Arlington, VA 22202.

Attachment 1: Chemical Names and Structures

Code Name/ Synonym	Chemical Name	Chemical Structure
PARENT		
MON 119096/ Dicamba as the diglycolamine salt	**IUPAC:** 3,6-Dichloro-*o*-anisic acid **CAS:** 3,6-Dichloro-2-methoxybenzoic acid **CAS No.:** 104040-79-1 **Formula:** $C_8H_6Cl_2O_3$ **MW:** 221.04 g/mol **SMILES String:** CLc1ccc(CL)c(OC)c1C(=O)(O)